Strategic Astrophysics Technology

Demonstration of Starshade Starlight-Suppression Performance in the Field

Completed Technology Project (2014 - 2015)

Project Introduction

Identification and characterization of nearby habitable exoplanets has been identified by the Astro2010 Decadal survey as the most important science frontier in Astronomy for the coming decade. This proposal seeks to develop the starshade technology which will allow NASA to directly image and obtain spectra of nearby exoplanets, including exo-Earths. Our milestone goal is to: Measure contrast of <1E-9 over >50% bandpass, establish that the measurement is stable and repeatable, model performance consistent with the measured results, and validate model predictions of the performance of a range of starshade shapes. This validated contrast milestone will significantly advance the starshade technology in the TDEM focus area of 'starlight suppression demonstrations'. Together with ongoing starshade development activities, the completion of this work is critical for an informed exoplanet mission architecture decision to be made later this decade. We propose here to continue our ongoing program of demonstrating the contrast performance of scaled-down starshade systems, thereby verifying starlight-suppression performance and validating critical numerical models. This team has already brought the starshade starlight-suppression technology to TRL 4 through a new testing campaign in which we observed a 60cm diameter starshade occulting the light from an artificial 'star', as seen with a telescope 0.5-1.5km away in a field environment. We were able to reach measured contrast of ~1E-8 at the edge of the starshade. The members of this team have also developed several high-fidelity numerical codes for modeling the diffraction performance of starshades and achieved preliminary agreement of the measurements with model predictions. Our 18 month program will bring the technology to TRL 5 by building on our previous work with three additional rounds of field testing. We will test a variety of starshade shapes, improve the shape fidelity of the test articles, upgrade the site, enhance our optical simulation, and control the impact of atmospheric effects. As we progress, we will conduct modeling and analysis between each round of testing to refine the methodology.

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Strategic Astrophysics Technology

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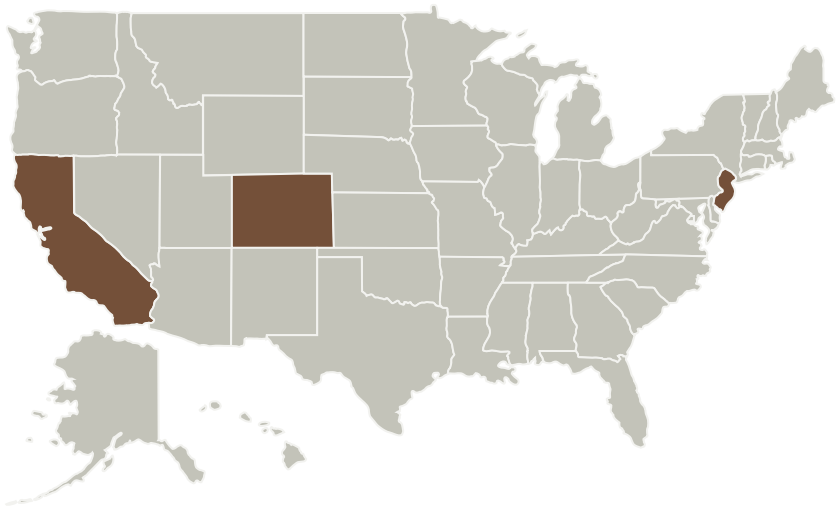
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Northrop Grumman Aerospace Systems(NGAS)	Supporting Organization	Industry	Redondo Beach, California
Northrop Grumman Systems Corporation	Supporting Organization	Industry	Falls Church, Virginia
Princeton University	Supporting Organization	Academia	Princeton, New Jersey
University of Colorado Boulder	Supporting Organization	Academia	Boulder, Colorado

Primary U.S. Work Locations	
California	Colorado
New Jersey	

Project Management

Program Director:

Mario R Perez

Program Manager:

Mario R Perez

Principal Investigator:

Tiffany M Glassman

Co-Investigators:

Steven J Warwick
Lyla S Casement
Webster Cash
Anthony D Harness
Robert J Vanderbei
N Jeremy Kasdin
Oscar P Bruno

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.2 Modeling
    - TX11.2.3 Human-System Performance Modeling

Target Destination

Outside the Solar System